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ARTICLE

Generic names in *Magnaporthales*

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Abstract: The order *Magnaporthales* comprises about 200 species and includes the economically and scientifically important rice blast fungus and the take-all pathogen of cereals, as well as saprotrophs and endophytes. Recent advances in phylogenetic analyses of these fungi resulted in taxonomic revisions. In this paper we list the 28 currently accepted genera in *Magnaporthales* with their type species and available gene and genome resources. The polyphyletic *Magnaporthe* 1972 is proposed for suppression, and *Pyricularia* 1880 and *Nakataea* 1939 are recommended for protection as the generic names for the rice blast fungus and the rice stem rot fungus, respectively. The rationale for the recommended names is also provided. These recommendations are made by the *Pyricularia*/*Magnaporthe* Working Group established under the auspices of the International Commission on the Taxonomy of Fungi (ICTF).

Key words:
Ascomycota
Magnaporthe
Nakataea
one fungus-one name
pleomorphic fungi
Pyricularia
rice blast
take-all

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INTRODUCTION

Magnaporthales (*Sordariomycetes, Ascomycota*) contains important pathogens of cereals and grasses, including the rice blast fungus *Pyricularia oryzae* (*Magnaporthe oryzae*), the take-all pathogen of cereals *Gaeumannomyces graminis*, the rice stem rot pathogen *Nakataea oryzae* (*Magnaporthe salvinii*) and the summer patch pathogen of turf grass *Magnaporthiopsis poae* (Cannon 1994, Thongkantha *et al.* 2009). To date, about 200 species have been described in *Magnaporthales*, of which approximately 50 % are pathogens of domesticated and wild monocotyledons.

The rice blast fungus has conidial (asexual) and ascosporic (sexual) morphs and the rice stem rot fungus produces sclerotial (asexual), conidial (asexual) and ascosporic (sexual) morphs. Historically, such pleomorphy added to the difficulty in resolving taxonomic and nomenclatural problems associated with these species.

Recent advancement in gene, transcriptome and genome sequencing of *Magnaporthales* fungi resulted in robust phylogenies, which correspond well with the pathogenicity, ecology and biology of these species. However, the phylogenies conflict with certain traditional generic concepts based on morphology. *Magnaporthe* and *Gaeumannomyces*, for example, were shown to be polyphyletic. Taxonomic revisions have been carried out for some of these taxa in recent publications (Luo & Zhang 2013, Klaubauf *et al.* 2014, Luo *et al.* 2015a). In this paper, we list 28 accepted genera in *Magnaporthales* and provide the rationale for the recommended genera if there is competition.

A list of accepted generic names in *Magnaporthales,* with the type species, is compiled in Table 1 including references that serve as the basis for recognizing these genera. This follows approval of their usage by the *Pyricularia/Magnaporthe* Working Group, without prejudice. Cases that require action to be approved by the Nomenclature Committee for Fungi (NCF) are indicated by an asterisk in that Table.

RECOMMENDATIONS

(A) = a name typified by an asexual morph, (S) = a name typified by a sexual morph.

Use *Nakataea* Hara 1939 (A) rather than *Magnaporthe* R.A. Krause & R.K. Webster 1972 (S)

Cattaneo (1876) first named the rice stem rot pathogen as *Sclerotium oryzae* based on the sclerotial morph. In the same paper he also described *Leptosphaeria salvinii*, which was later recognized as the sexual morph of the same fungus (Tullis 1933). Hara (1939) named the conidial morph of the species *Nakataea sigmoidea*. Krause & Webster (1972) then established the new generic name *Magnaporthe,* typified by the ascosporic morph, to accommodate the rice stem rot pathogen as *Magnaporthe salvinii*, as necessitated by the nomenclatural rules then in force. *Sclerotium* and *Leptosphaeria* currently belong in *Basidiomycota* and *Dothideomycetes* respectively (Xu *et al.* 2010), and are therefore not applicable to this sordariomycetous species. *Nakataea* and *Magnaporthe* are congeneric and their type species, *Nakataea sigmoidea* and *Magnaporthe salvinii*, refer to the same species (Krause & Webster 1972). Subsequent to the ending of the separate naming of morphs of the same fungus species in 2011, under Art. 59.1 of the *International Code of Nomenclature for algae, fungi, and plants* (ICN; McNeill *et al.* 2012), Luo *et al*. (2013) made a new combination for the rice stem rot fungus as *Nakataea oryzae*, using the oldest legitimate generic name and species epithet. Those authors did not, however, formally propose the rejection or suppression of the later sexually typified names as currently required by Art. 57.2. We note that it is proposed that this requirement be eliminated from the ICN in 2017 (Hawksworth 2015), but it is currently in force.

Use *Pyricularia oryzae* Cavara 1892 (A) rather than *Magnaporthe oryzae* (Catt.) B.C. Couch 2002 (S)

In 1880, Saccardo established the generic name *Pyricularia* based on the asexually typified *P. grisea* on crabgrass. The rice isolates were designated as *P. oryzae* in 1892 by Cavara, which now is known as the rice blast fungus. Since then, over 50 species have been listed as *Pyricularia* that cause blast diseases of monocotyledonous plants.

The sexual morph of *Pyricularia* was first observed in 1970 from laboratory crossing experiments and believed to belong to *Magnaporthe* because of the similarity in ascospore morphology (Hebert 1970, Barr 1977, Couch & Kohn 2002). However, recent phylogenetic and phylogenomic analyses demonstrated that the sexually typified genus *Magnaporthe* was polyphyletic. The rice blast fungus is not congeneric with the type species of *Magnaporthe*, *M. salvinii,* and the placement of the rice blast fungus in *Magnaporthe* was based on an incorrect morphological identification (Zhang *et al.* 2011, Luo & Zhang 2013, Luo *et al.* 2014, Murata *et al.* 2014, Luo *et al.* 2015a). This is not a nomenclatural issue because the generic names *Magnaporthe* and *Pyricularia* are not congeneric and so do not compete for priority.

Pyricularia and *Magnaporthe* are currently both widely used generic names, and the rice blast fungus is an economically and scientifically important species that deserves much caution. The *Pyricularia*/*Magnaporthe* Working Group has considered the possibility of conserving the name *Magnaporthe* over *Pyricularia*. However, such conservation would require a change in the type species of the genus *Magnaporthe,* and would cause numerous name changes for those species currently placed in *Pyricularia.*

The asexually typified generic name *Pyricularia* is the correct name for the rice blast fungus, which corresponds well with pathogenicity and ecological and evolutionary features. The name *Pyricularia oryzae* should therefore be used for the rice blast fungus. The synonym *Magnaporthe oryzae,* can nevertheless continue to be mentioned in publications as "*Pyricularia oryzae* (syn. *Magnaporthe oryzae*)". This practice will help to bridge a potential gap in the literature and knowledge for this important species.

Use *Clasterosporium* Schwein. 1832 (A) rather than *Clasterosphaeria* Sivan. 1984 (S)

The generic name *Clasterosphaeria,* typified by *C. cyperi,* was established for the sexual morph of *Clasterosporium cyperi* and includes only two names. The generic name *Clasterosporium* based on *C. caricinum* includes 158 names, many of which have been placed in other genera. Whether or not *Clasterosphaeria cyperi* is congeneric with *Clasterosporium caricinum* is not known, although this seems likely given that both occur on *Cyperaceae*. If this is the case, use of the older, more commonly used generic name *Clasterosporium* is recommended.

Use *Gaeumannomyces* Arx & D.L. Olivier 1952 (S) rather than *Harpophora* Gams 2000 (A)

The generic name *Gaeumannomyces,* typified by *G. graminis,* has long been used for the cause of take-all of wheat disease (Walker 1972, 1980). *Harpophora* was established for phialophora-like species that were known to be asexual morphs related to *Gaeumannomyces* and *Magnaporthe* but did not produce a sexual morph (Gams 2000). With the change to one name, *Harpophora* based on *H. radicicola* is to be considered a synonym of *Gaeumannomyces,* based on phylogeny (Luo *et al.* 2015b). Given the greater number of species, priority, and numerous reports, we see no reason not to use the first published name, *Gaeumannomyces.*

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Table 1. Accepted generic names in *Magnaporthales* with type species, number of species in each genus, and gene or genomic resources. Names needing approval are indicated by an asterisk (*).

Taxa	Type species	Number of species	GenBank accession numbers for gene and genome sequence data**
MAGNAPORTHACEAE			
Buergenerula Syd. in Annls mycol. 34: 392. 1936.	***Buergenerula biseptata*** (Rostr.) Syd. 1936. (*Metasphaeria biseptata* Rostr. 1904).	4	*Buergenerula spartinae*: transcriptome (SRX798618) (Luo *et al.* 2015a).
Bussabanomyces Klaubauf *et al.* in Stud. Mycol. 79: 100. 2014.	***Bussabanomyces longisporus*** (Bussaban) Klaubauf *et al.* 2014. (*Pyricularia longispora* Bussaban 2003).	1	*Bussabanomyces longisporus*: transcriptome (SRX798619) (Luo *et al.* 2015a).
Ceratosphaerella Huhndorf *et al.* in Mycologia 100: 941. 2008.	***Ceratosphaerella castillensis*** (C.L. Sm.) Huhndorf *et al.* 2008.	2	*Ceratosphaerella castillensis*: ITS (EU527997), LSU (EU528003) (Huhndorf *et al.* 2008).
Ceratosphaeria Niessl in Verh. nat. Ver. Brünn 14: 203. 1876.	***Ceratosphaeria lampadophora*** (Berk. & Broome) Niessl 1876.	34	*Ceratosphaeria lampadophora*: ITS (AY761088), LSU (AY346270) (Huhndorf *et al.* 2008).
* ***Clasterosporium*** Schwein. in Trans. Am. phil. Soc., New Series 4: 300. 1832. = *Clasterosphaeria* Sivan. in Trans. Brit. mycol. Soc. 83: 710. 1984.	***Clasterosporium caricinum*** Schwein. 1832.	158	
Clavatisporella K.D. Hyde in Mycotaxon 55: 276. 1995.	***Clavatisporella musicola*** K.D. Hyde 1995.	1	
Falciphora J. Luo & N. Zhang in Mycologia 107: 643. 2015.	***Falciphora oryzae*** (Z.L. Yuan *et al.*) J. Luo & N. Zhang 2015.	1	*Falciphora oryzae* genome (JNVV01000000) (Xu *et al.* 2014).
Gaeumannomyces Arx & D.L. Olivier in Trans. Brit. mycol. Soc. 35: 32. 1952. = *Harpophora* W. Gams in Stud. Mycol. 45: 192. 2000.	***Gaeumannomyces graminis* var. *graminis*** (Sacc.) Arx & D.L. Olivier 1952.	7	*Gaeumannomyces graminis* var. *avenae*: transcriptome (SRX798620) (Luo *et al.* 2015a); *Gaeumannomyces graminis* var. *graminis*: transcriptome (SRX798621) (Luo *et al.* 2015a); *Gaeumannomyces graminis* var. *tritici*: genome (ADBI00000000) (Okagaki *et al.* 2015).
Herbampulla Scheuer & Nograsek in Mycotaxon 47: 419. 1993.	***Herbampulla crassirostris*** Scheuer & Nograsek 1993	1	
Kohlmeyeriopsis Klaubauf *et al.* in Stud. Mycol. 79: 101. 2014.	***Kohlmeyeriopsis medullaris*** (Kohlm., Volkm.-Kohlm. & O.E. Erikss.) Klaubauf *et al.* 2014.	1	*Kohlmeyeriopsis medullaris*: SSU(FJ176801), ITS(KM484852), LSU(FJ176801), *RPB1*(KM485069) (Klaubauf *et al.* 2014).
Magnaporthiopsis J. Luo & N. Zhang in Mycologia 105: 1021. 2013.	***Magnaporthiopsis poae*** (Landsch. & N. Jacks.) J. Luo & N. Zhang 2013.	5	*Magnaporthiopsis incrustans*: genome (SRX795321), transcriptome (SRX798625) (Luo *et al.* 2015a); *Magnaporthiopsis panicorum*: transcriptome (SRX798626) (Luo *et al.* 2015a); *Magnaporthiopsis poae*: genome (ADBL01000000) (Okagaki *et al.* 2015); *Magnaporthiopsis rhizophila*: genome (SRX798599), transcriptome (SRX798627) (Luo *et al.* 2015a).
Muraeriata Huhndorf *et al.* in Mycologia 100: 948. 2008.	***Muraeriata collapsa*** Huhndorf, Greif, Mugambi & A.N. Mill. 2008.	2	*Muraeriata collapsa*: LSU (EU527996) (Huhndorf *et al.* 2008).

Table 1. (Continued).

Taxa	Type species	Number of species	GenBank accession numbers for gene and genome sequence data**
* ***Nakataea*** Hara, Diseases Rice Plant, 2nd : 185. 1939. = *Magnaporthe* R.A. Krause & R.K. Webster in Mycologia 64: 110. 1972.	***Nakataea oryzae*** (Catt.) J. Luo & N. Zhang 2013.	7	*Nakataea oryzae*: genome (SRX798605), transcriptome (SRX798628) (Luo *et al.* 2015a).
Omnidemptus P.F. Cannon & Alcorn in Mycotaxon 51: 483. 1994.	***Omnidemptus affinis*** P.F. Cannon & Alcorn 1994.	1	*Omnidemptus affinis*: transcriptome (SRX798629) (Luo *et al.* 2015a).
Pseudophialophora J. Luo & N. Zhang in Mycologia 106: 581. 2014.	***Pseudophialophora eragrostis*** J. Luo & N. Zhang 2014.	8	*Pseudophialophora eragrostis*: transcriptome (SRX798634) (Luo *et al.* 2015a); *Pseudophialophora panicorum*: transcriptome (SRX798635) (Luo *et al.* 2015a); *Pseudophialophora schizachyrii*: transcriptome (SRX798637) (Luo *et al.* 2015a).
Pyriculariopsis M.B. Ellis, Demat. Hyphom.: 206. 1971.	***Pyriculariopsis parasitica*** (Sacc. & Berl.) M.B. Ellis 1971.	1	*Pyriculariopsis parasitica*: LSU(DQ341514) (Klaubauf *et al.* 2014).
Slopeiomyces Klaubauf *et al.* in Stud. Mycol. 79: 102. 2014.	***Slopeiomyces cylindrosporus*** (D. Hornby *et al.*) Klaubauf *et al.* 2014.	1	*Slopeiomyces cylindrosporus*: transcriptome (SRX798639) (Luo *et al.* 2015a).
OPHIOCERACEAE			
Ophioceras Sacc., Syll. Fung. 2: 358. 1883.	***Ophioceras dolichostomum*** (Berk. & M.A. Curtis) Sacc. 1883.	33	*Ophioceras dolichostomum*: genome (SRX798611) (Luo *et al.* 2015a); *Ophioceras commune*: transcriptome (SRX798630) (Luo *et al.* 2015a); *Ophioceras leptosporum*: transcriptome (SRX798632) (Luo *et al.* 2015a).
Pseudohalonectria Minoura & T. Muroi in Trans. Mycol. Soc. Japan 19: 132. 1978.	***Pseudohalonectria lignicola*** Minoura & T. Muroi 1978.	13	*Pseudohalonectria lignicola*: genome (SRX798616), transcriptome (SRX798633) (Luo *et al.* 2015a).
PYRICULARIACEAE			
Bambusicularia Klaubauf *et al.* in Stud. Mycol. 79: 104. 2014.	***Bambusicularia brunnea*** Klaubauf *et al.* 2014.	1	*Bambusicularia brunnea*: ITS(KM484830), LSU(KM484948), *ACT*(AB274449), *CAL*(AB274482), *RPB1*(KM485043) (Klaubauf *et al.* 2014).
Barretomyces Klaubauf *et al.* in Stud. Mycol. 79: 104. 2014.	***Barretomyces calatheae*** (D.J. Soares *et al.*) Klaubauf *et al.* 2014.	1	*Barretomyces calatheae*: ITS(KM484831), LSU(KM484950), *ACT*(KM485162), *CAL*(KM485231), *RPB1*(KM485045) (Klaubauf *et al.* 2014).
Deightoniella S. Hughes in Mycol. Pap. 48: 27. 1952.	***Deightoniella africana*** S. Hughes 1952.	20	
Macgarvieomyces Klaubauf *et al.* in Stud. Mycol. 79: 106. 2014.	***Macgarvieomyces borealis*** (de Hoog & Oorschot) Klaubauf *et al.* 2014.	2	*Macgarvieomyces borealis*: SSU(DQ341511), ITS(KM484854), LSU(DQ341511), *ACT*(KM485170), *CAL*(KM485239), *MCM7*(KM009174), *RPB1*(KM485070), *TEF1*(KM009198) (Klaubauf *et al.* 2014, Luo *et al.* 2015a); *Macgarvieomyces juncicola*: transcriptome sequenced (SRX798624) (Luo *et al.* 2015a).
Neopyricularia Klaubauf *et al.* in Stud. Mycol. 79: 108. 2014.	***Neopyricularia commelinicola*** (M.J. Park & H.D. Shin) Klaubauf *et al.* 2014.	1	*Neopyricularia commelinicola*: SSU(KM009211), ITS(FJ850122), LSU(KM484985), *ACT*(KM485175), *CAL*(KM485243), *MCM7*(KM009175), *RPB1*(KM485087), *TEF1*(KM009199) (Klaubauf *et al.* 2014, Luo *et al.* 2015a).
Proxipyricularia Klaubauf *et al.* in Stud. Mycol. 79: 109. 2014.	***Proxipyricularia zingiberis*** (Y. Nisik.) Klaubauf *et al.* 2014.	1	*Proxipyricularia zingiberis*: ITS(KM484869), LSU(KM484986), *ACT*(AB274448), *CAL*(KM485244), *RPB1*(KM485088) (Klaubauf *et al.* 2014).

Table 1. (Continued).

Taxa	Type species	Number of species	GenBank accession numbers for gene and genome sequence data**
Pseudopyricularia Klaubauf *et al.* in Stud. Mycol. 79: 109. 2014.	***Pseudopyricularia kyllingae*** Klaubauf *et al.* 2014.	3	*Pseudopyricularia kyllingae*: ITS(KM484876), LSU(KM484992), *ACT*(AB274451), *CAL*(AB274484), *RPB1*(KM485096) (Klaubauf *et al.* 2014).
Pyricularia Sacc. in Michelia 2: 20. 1880.	***Pyricularia grisea*** Sacc. 1880.	55	*Pyricularia grisea*: transcriptome (SRX798638) (Luo *et al.* 2015a); genome (PRJEB7653 at http://genome.jouy.inra.fr/gemo/) *Pyricularia oryzae*: Genome (Dean *et al.* 2005).
Xenopyricularia Klaubauf *et al.* in Stud. Mycol. 79: 116. 2014.	***Xenopyricularia zizaniicola*** (Hashioka) Klaubauf *et al.* 2014.	1	*Xenopyricularia zizaniicola*: transcriptome (SRX798640) (Luo *et al.* 2015a).

** Unpublished genome data are not listed.

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